PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-240212

(43)Date of publication of application : 12.09.1995

(51)Int.Cl.

H01M 8/00
B60K 1/04
B60K 6/00
B60K 8/00
H01M 10/44

(21)Application number : 06-053326

(22)Date of filing : 24.02.1994

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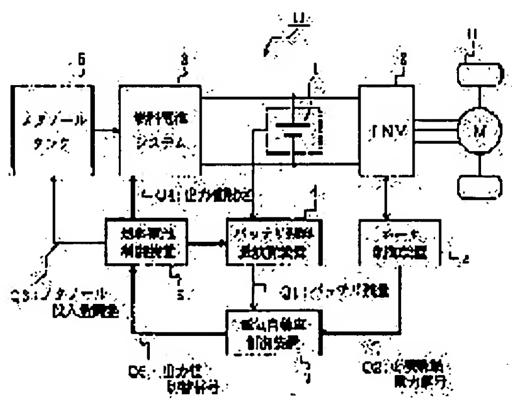
(54) HYBRID ELECTRIC POWER SOURCE DEVICE

(57)Abstract:

PURPOSE: To improve the fuel consumption efficiency by properly selecting the output of a fuel cell to charge a secondary battery based on the charged state of the secondary battery.



CONSTITUTION: A secondary battery 1, e.g. a lead-acid battery, etc., supplies electric power to a drive motor M through an inverter 2 which is controlled by signals from, for example, an accelerator pedal. A fuel cell 3 is connected with the secondary battery 1 in parallel and charged, so that the driving period of the motor M is extended. A CPU 7 recognizes the charged degree of the secondary battery 1 through a secondary battery remaining capacity computing apparatus 4 and based on the results, it controls the output of the fuel cell 3 through a fuel battery controlling apparatus 5. Since the fuel consumption efficiency to the output of the fuel cell 3 is high when the output is small, the output is set to be the necessary minimum level to carry out charging, independently of the necessary input electric power for the motor M. For example, at 60 or 70% of the charged degree as the boundary level from the lower level, the output is changed to be 10, 5, 3W, respectively, in stages.

LEGAL STATUS

[Date of request for examination]	19.01.2001
[Date of sending the examiner's decision of rejection]	27.01.2004
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3599773
[Date of registration]	24.09.2004
[Number of appeal against examiner's decision of rejection]	2004-03871
[Date of requesting appeal against examiner's decision of rejection]	26.02.2004
[Date of extinction of right]	

CLAIMS

[Claim(s)]
[Claim 1] The hybrid power unit characterized by providing the rechargeable battery which supplies the power for a drive of a motor, the fuel cell which supplies power to this rechargeable battery, a rechargeable battery remaining capacity detection means to detect said rechargeable battery charge remaining capacity, and a fuel cell output-control means to order it the output value of said fuel cell according to the charge remaining capacity of said rechargeable battery.
[Claim 2] Said fuel cell output-control means is a hybrid power unit according to claim 1 characterized by determining the fuel supplied to said fuel cell as an output value of the fuel cell which it is ordered based on the overall efficiency changed into the power for a drive of said motor.
[Claim 3] It is the hybrid power unit according to claim 1 characterized by for said rechargeable battery remaining capacity detection means computing the percent change of the charge remaining capacity of said rechargeable battery, and determining said fuel cell output-control means according to the percent change of the charge remaining capacity of said rechargeable battery computed with this rechargeable battery remaining capacity detection means as an output value of the fuel cell which it is ordered.
[Claim 4] It is the hybrid power unit according to claim 1 which is equipped with a power detection means detect the power which the drive of said motor takes, and a fuel cell output detection means detect the power outputted from said fuel cell, and is characterized by for said rechargeable battery remaining-capacity detection means to detect said rechargeable battery charge remaining capacity from the power detected with said current detection means, and the power detected with said fuel cell output detection means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the hybrid power unit which is built over a hybrid power unit, for example, is used for motorised [of an electric vehicle].
[0002]
[Description of the Prior Art] In recent years, the gasoline engine used as the generation source of harmful gas etc. is not made into a driving source from a viewpoint of earth environmental protection, but the electric vehicle which makes a car drive with clean power attracts attention. By the way, the rechargeable battery used for an electric vehicle has comparatively small energy capacity, although an output capacitance is large. Therefore, in the electric vehicle which uses a rechargeable battery as a power source, the distance it can run by one charge is around 100km, and there is a remarkable difference as compared with the mileage after [1 time of] full of the present gasoline-powered vehicle it runs by the gasoline engine being 400-500km. Then, in order to extend the distance of an electric vehicle which can be run, although an output capacitance is small, the hybrid power unit which combined the fuel cell with large energy capacity and the rechargeable battery is developed. Such a hybrid power unit is used for the bus or the golf cart in a tentative way.
[0003] Drawing 6 is the block diagram of the conventional hybrid power unit indicated by JP,3-276573,A. As shown in drawing 6 , the amount of treading in of an accelerator pedal 55 is inputted into the 1st input terminal of a computing element 61 through a potentiometer 56. After adding the signal from remaining capacity 60 [a total of] of a dc-battery 53 to the load command of the car according to the amount of treading in of an accelerator pedal 55, a computing element 61 calculates the amount of fuel gas supplied to a fuel cell 51, and supplies it to the controller 57. Based on the supplied result of an operation, a chopper 52 is controlled by the controller 57, and the car according to the amount of treading in of an accelerator pedal 55 is driven. Moreover, in order to supply power required for the drive of a car to a chopper 52, based on the result of an operation of a computing element 61, an air blower 59 is controlled by the controller 57 with a flow control servo valve 62, and the output of a fuel cell 51 is controlled by it. In addition, the dc-battery 53 in the conventional hybrid power unit is for backing up the lack of an output of the fuel cell 51 which produces a car at the time of load rapid increase of carrying out sudden acceleration transit, and is charged with the dump power of a fuel cell 51 at the time of a light load.
[0004]
[Problem(s) to be Solved by the Invention] In the conventional hybrid power unit, the fuel cell 51 was made to generate corresponding to the amount of treading in of an accelerator pedal 55, and the speed was controlled in the car. For this reason, the output of a fuel cell 51 was also changed according to the change in the load command of a car. By the way, the "fuel cell output-system overall-efficiency property" of a fuel cell draws a curve as shown in drawing 7 . As shown in this drawing 7 , the fuel cell has the property that system overall efficiency (conversion efficiency of = fuel) falls, with the increment in an output value. In addition, as for system overall efficiency, factors, such as fuel conversion efficiency of a fuel cell layered product, a fuel gas supply pressure, reforming machine thermal efficiency, and fuel cell laminating effectiveness, are taken into consideration. For this reason, in the conventional hybrid power unit, since it was made to change according to the change in the load command of the output of a fuel cell 51 of a car, when a high load was required like [at the time of acceleration and high-speed transit], naturally, the output of a fuel cell 51 also became high and system overall efficiency was driving the fuel cells 51 also including the range where less than 30% of

effectiveness is bad. Especially, in the hybrid power unit given [said] in an official report, after adding the signal from dc-battery remaining capacity 60 [a total of] not only to the load command of the car by the amount of accelerator treading in but to this, since it had opted for the output of a fuel cell 51, the fuel cell was driven in the range where effectiveness is still worse. Moreover, since the operation stroke until the load command of the car by the amount of accelerator treading in is changed into the amount of distributed gas to a fuel cell is long, responsibility is bad. Moreover, to the output of a fuel cell, it is not indirectly controlled through the amount of distributed gas.
[0005] Then, it was made in order that this invention might solve such a technical problem, and it aims at offering an efficient hybrid power unit.
[0006]
[Means for Solving the Problem] The rechargeable battery which supplies the power for motorised in invention according to claim 1, The fuel cell which outputs the power for charging this rechargeable battery, and a rechargeable battery remaining capacity detection means to detect the remaining capacity of said rechargeable battery, In the range said whose system overall efficiency is 30 - 40%, corresponding to the percent change of the charge remaining capacity of said rechargeable battery detected with this rechargeable battery remaining capacity detection means, or charge remaining capacity A hybrid power unit is made to possess a fuel cell output-control means to change the output value of said fuel cell in the range of 10kW or less, and said purpose is attained.
[0007] In invention according to claim 2, in a hybrid power unit according to claim 1, said rechargeable battery remaining capacity detection means detects the charge remaining capacity of said rechargeable battery, said fuel cell output-control means is the range said whose system overall efficiency is 30 - 40%, corresponding to the charge remaining capacity of said rechargeable battery detected with this rechargeable battery remaining capacity detection means, and the output value of said fuel cell is changed in the range of 10kW or less. In invention according to claim 3, in a hybrid power unit according to claim 1, said rechargeable battery remaining capacity detection means computes the percent change of the charge remaining capacity of said rechargeable battery, said fuel cell output-control means is the range said whose system overall efficiency is 30 - 40%, corresponding to the percent change of said rechargeable battery remaining capacity computed with this rechargeable battery remaining capacity detection means, and the output value of said fuel cell is changed in the range of 10kW or less. It has a power detection means detect the power which the drive of said motor takes, and a fuel cell output detection means detect the power outputted from said fuel cell, and said rechargeable battery remaining-capacity detection means detects said rechargeable battery charge remaining capacity in a hybrid power unit according to claim 1 in invention according to claim 4 from the power detected with said current detection means, and the power detected with said fuel cell output detection means.
[0008]
[Function] The remaining capacity of a rechargeable battery is detected and a fuel cell output-control means changes the output value of a fuel cell in the range of 10kW or less in a hybrid power unit according to claim 1 according to the remaining capacity of the detected rechargeable battery in the range for example, whose system overall efficiency is 30 - 40% with a rechargeable battery remaining capacity detection means. In invention according to claim 2, the fuel which supplies the output value of the fuel cell which it is ordered to a fuel cell is determined based on the overall efficiency changed into the power for a drive of said motor. In a hybrid power unit according to claim 3, the output value of the fuel cell which it is ordered is determined according to the percent change of the charge remaining capacity of the rechargeable battery computed with the rechargeable battery remaining capacity detection means. In a hybrid power unit according to claim 4, rechargeable battery charge remaining capacity is detected from the power which the drive of a motor takes, and the power outputted from a fuel cell.
[0009]
[Example] Hereafter, the example in the hybrid power unit of this invention is explained to a detail with reference to drawing 1 thru/or drawing 5 . Drawing 1 expresses the system configuration at the time of applying the hybrid power unit H of the example of this invention to an electric vehicle. This hybrid power unit H is equipped with the dc-battery 1 as a "rechargeable battery" for supplying the power for driving the motor M of an electric vehicle. As this dc-battery 1, various rechargeable batteries, such as a lead acid battery, a nickel-cadmium battery, a sodium sulfur cell, a lithium secondary battery, a hydrogen rechargeable battery, and a

redox type cell, are used, for example. By connecting two or more sets of rechargeable batteries to a serial parallel in series, this dc-battery 1 is constituted so that it may become the electrical potential difference of 240 [V]. The dc-battery cel of 12 [V] is connected to the 20-piece serial with the dc-battery 1 of this example.
[0010] The dc-battery 1 is connected to the fuel cell system 3 containing the evaporation section, the reforming section (not shown), etc. while connecting with the inverter 2 which changes a direct current into an alternating current. As this fuel cell system 3, various fuel cell systems, such as a phosphoric acid mold, a melting carbonate mold, a quality type of solid-state electric field, and a solid-state polymer electrolyte membrane mold, are used, for example. Moreover, the dc-battery 1 is connected to the dc-battery remaining capacity arithmetic unit (State Of Charge) 4. The dc-battery remaining capacity arithmetic unit 4 functions as a "rechargeable battery remaining capacity detection means" to detect the charge remaining capacity of a dc-battery 1. That is, the dc-battery remaining capacity arithmetic unit 4 calculates operating electric energy by calculating the power used from a dc-battery 1 by the inverter 2 based on the time variation of the terminal voltage of a dc-battery 1, and a current. Moreover, the output-value setting signal Q4 which shows the output value of the fuel cell system 3 to the dc-battery remaining capacity arithmetic unit 4 is supplied from the fuel cell control device 6, and the charge of a dc-battery 1 calculates from this output-value setting signal Q4. The charge remaining capacity of a dc-battery 1 is calculated with a sufficient precision from this calculated charge and operating electric energy. In addition, the dc-battery remaining capacity arithmetic unit 4 detects the electrical potential difference of the dc-battery 1 in the case of being in predetermined remaining capacity about the charge remaining capacity of a dc-battery 1, and you may make it ask for it from this battery voltage. Moreover, you may make it the dc-battery remaining capacity arithmetic unit 4 calculate the charge remaining capacity of a dc-battery 1 by measuring the remaining capacity of the electrolytic solution by acting as the monitor of the specific gravity fluctuation of the dc-battery electrolytic solution with an optical detector. Moreover, you may make it the dc-battery remaining capacity arithmetic unit 4 calculate the charge remaining capacity of a dc-battery 1 by measuring the amount of discharge of a dc-battery. Moreover, you may make it the dc-battery remaining capacity arithmetic unit 4 calculate the charge remaining capacity of a dc-battery 1 from the discharge voltage and the charging time at the time of dc-battery discharge.
[0011] An inverter 2 is connected to motor control equipment 8 while it is arranged between a dc-battery 1 and the motor M attached in the car 11. As this motor M, DC brushless motor is used, for example. Motor control equipment 8 carries out drive control of the inverter 2 according to the transit command from the accelerator which is not illustrated. An inverter 2 is changing the basis of control of this motor control equipment 8, and the direct current power from a dc-battery 1 into alternating current power, and supplying Motor M, and is controlling transit of an electric vehicle. This motor control equipment 8 supplies the need [of being equivalent to the power of the dc-battery 1 used by driving Motor M with an inverter 2] drive power signal Q2 to the electric vehicle control device 7.
[0012] The electric vehicle control device 7 is realized by the microcomputer equipped with ROM (read only memory) in which CPU (central processing unit), and various kinds of programs and data were stored, RAM (random access memory) used as working area. The flag field for making the 1st according to remaining capacity of dc-battery 1 to 3rd flag turn on and turn off is secured to RAM.
[0013] While the electric vehicle control unit 7 controls the whole electric vehicle system, it functions as a fuel cell output-control means, and according to the dc-battery remaining capacity Q1 calculated with the dc-battery remaining capacity arithmetic unit 4, system overall efficiency supplies the output-value change signal Q5 for changing the output value of a fuel cell 3 to the fuel cell control unit 6 in the range which is 30 - 40%. Moreover, the electric vehicle control device 7 functions also as a rechargeable battery remaining capacity detection means to compute the percent change of the charge remaining capacity of a dc-battery 1, and outputs the output-value change signal Q5 according to the computed percent change. When computing the percent change of the charge remaining capacity of a dc-battery 1, the electric vehicle control unit 7 is computed from the need [of being supplied from the output-value change signal Q5 and the motor control equipment 8 which are supplied to the fuel cell control unit 6] drive power signal Q2.
[0014] as the output-value change signal Q5 outputted from the electric vehicle control unit 7 -- three kinds, Q53, Q55, and Q510, -- existing . These output-value change signals Q53, Q55, and Q510 are signals which direct that the fuel cell system 3 drives by the output of 3kW, 5kW, and 10kW to the fuel cell control unit 6, respectively. Thus, according to the remaining capacity of a dc-battery 1, as shown in drawing 7 , the electric

vehicle control device 7 chooses the range where system overall efficiency is high, for example, 30 - 40% of range, and directs the output of the fuel cell system 3. Here, the output of 10kW (it is about 30% of effectiveness in the part of the sign C1 of drawing 7) of the fuel cell system 3 is the value of an upper limit permissible as efficient range, although some system overall efficiency is low compared with 3kW (it is about 32% of effectiveness in the part of the sign B1 of drawing 7), or 5kW (it is about 33% of effectiveness in the part of the sign A1 of drawing 7).

[0015] On the other hand, the fuel cell system 3 is connected to the methanol tank 5 in which the methanol was stored. The fuel cell system 3 and the methanol tank 5 are connected to the fuel cell control unit 6. The fuel cell control unit 6 supplies the methanol input adjustment signal Q3 to the methanol tank 5, and sends out the output-value setting signal Q4 to the fuel cell system 3 so that the output from the fuel cell system 3 may turn into an output according to the contents of the output-value change signal Q5 supplied from the electric vehicle control unit 7. From the methanol tank 5, the methanol according to the methanol input adjustment signal Q3 is supplied to the fuel cell system 3. While reforming the methanol supplied in the fuel cell system 3, a dc-battery 1 is charged with the output according to the charge remaining capacity and the percent change of a dc-battery 1 by the oxygen supply according to the output-value setting signal Q4 etc.

[0016] Next, actuation of the hybrid power unit H constituted in this way is explained.

(1) The 1st actuation of the 1st ****** of an example charges a dc-battery 1 according to the charge remaining capacity of the dc-battery 1 detected with the dc-battery remaining capacity arithmetic unit 4, changing the output value of said fuel cell in the efficient range. In addition, the following examples shall express the charge remaining capacity of a dc-battery 1 by the charge and charging rate of a dc-battery.

[0017] ** Whole actuation drawing 2 expresses actuation of the main routine which shows actuation by the whole hybrid power unit H. As shown in drawing 2 , first, an ignition key (IG) confirms whether to be ON or not at step 1, and when an ignition key is ON, initial setting is performed to the various control which (step 1; Y) and the electric vehicle control unit 7 perform (step 2). Subsequently, processing by the dc-battery charge routine concerning this example is performed (step 3), and after termination of this dc-battery charge routine, after performing processing by other manipulation routines (step 4), it shifts to step 2.

[0018] On the other hand, when ignition key-off is detected at step 1 (step 1; N), processing is ended after carrying out processing by IG off dc-battery charge routine (step 5). When an ignition key therefore does not suspend the fuel cell system 3 immediately off, but the output of the fuel cell system 3 when off is continued as it is as processing by IG off dc-battery charge routine, for example and a dc-battery 1 becomes a more than full charge, for example, 90%, here, the fuel cell system 3 is suspended.

[0019] ** Dc-battery charge routine drawing 3 expresses processing actuation of the dc-battery charge routine (step 3) in drawing 2 . As shown in this drawing 3 , first, from the operating electric energy of a dc-battery 1, and the charge from the fuel cell system 3, the dc-battery remaining capacity arithmetic unit 4 detects the charge (charging rate) of a dc-battery 1, and supplies the electric vehicle control unit 7 (step 11). In the electric vehicle control unit 7, when the detected charging rate is 90% or less, the 1st flag (90% or less flag) is set to the flag field secured to (step 12; Y) and RAM which is not illustrated (step 13), the charging rate of a dc-battery 1 confirms further whether to be 70% or less (step 14), and the 2nd flag (70% or less flag) is set to 70% or less of case (step 15). Subsequently, a charging rate confirms whether to be 60% or less (step 16), and the 3rd flag (60% or less flag) is set to 60% or less of case (step 17).

[0020] And when the 1st flag, the 2nd flag, and the 3rd flag are "ON, OFF, and OFF", respectively (step 18), more charging rates of a dc-battery 1 than 70% are in 90% or less of comparatively high condition. For this reason, since it is not necessary to charge a dc-battery 1 quickly, the electric vehicle control unit 7 has the highest effectiveness of the fuel cell system 3, and it supplies the output-value change signal Q53 to the fuel cell control unit 6 so that it may be set to 3kW with the lowest output. The output-value setting signal Q4 which is equivalent to 3kW from the fuel cell control unit 6 is supplied to the fuel cell system 3 by this, and a dc-battery 1 is charged with the most efficient output of 3kW (it is about 33% of effectiveness in the part of the sign A1 of drawing 7) (step 19).

[0021] Moreover, when the 1st flag, the 2nd flag, and the 3rd flag are not "ON, OFF, and OFF" at step 18, respectively, it is confirmed [(step 18; N) and] whether each flag is "ON, ON, and OFF", respectively (step 20). Although more charging rates of a dc-battery 1 than 60% are in 70% or less of condition and this does not need to charge quickly when it is "ON, ON, and OFF" (step 20;Y), it is in the condition whose dc-battery

charge has been decreasing to some extent. For this reason, although the electric vehicle control unit 7 is a high output somewhat, it supplies the output-value change signal Q55 to the fuel cell control unit 6 so that system overall efficiency may serve as an output of 5kW corresponding to the mean value of the range which is 30 - 40%. By this, the fuel cell system 3 charges a dc-battery 1 with an output with an output [corresponding to the mean value of said system overall-efficiency range] of 5kW (it is about 32% of effectiveness in the part of the sign B1 of drawing 7) (step 21).

[0022] Moreover, when the 1st flag, the 2nd flag, and the 3rd flag are not "ON, ON, and OFF" at step 20, respectively, it is confirmed [(step 20; N) and] whether each flag is "ON, ON, and ON", respectively (step 22). Since the charging rate of a dc-battery 1 is 60% or less and its charge of a dc-battery 1 has been decreasing to some extent when it is "ON, ON, and ON" (step 22;Y), before being in an overdischarge condition, it is necessary to perform a certain amount of charge. For this reason, although effectiveness is the lowest among efficient range, the output of 10kW in tolerance is chosen and the corresponding output-value change signal Q510 is supplied to the fuel cell control unit 6 from the electric vehicle control unit 7. By this, the fuel cell system 3 charges a dc-battery 1 with the output of 10kW (it is about 30% of effectiveness in the part of the sign C1 of drawing 7) used as the low effectiveness of the efficient range (step 23).

[0023] Moreover, since there are more (steps 22; N) and charging rates than 90% when the 1st flag, the 2nd flag, and the 3rd flag are not "ON, ON, and ON" in step 22, respectively, a return is carried out to a main routine. If a dc-battery charge routine is again performed in this condition, a dc-battery charge is detected again (step 11), and since a charging rate is not 90% or less in step 12 (step 12; N), the 1st flag, the 2nd flag, and the 3rd flag will be made sequential OFF (step 24 - step 26). In this case, since there are more dc-battery charges than 90%, the fuel cell system 3 is suspended (step 27), and a return is carried out to a main routine.

[0024] Drawing 4 expresses the run state of an electric vehicle, and the fuel cell output corresponding to this and the relation of dc-battery remaining capacity. As shown in this drawing (a), an electric vehicle shall run from a idle state in the state of various kinds, such as a high-speed condition and an acceleration condition, according to an accelerator, the amount of treading in of a brake, and a shift position. And in this example, as shown in (b), according to the charge (charge remaining capacity) of the dc-battery 1 instead of what controls the output of the fuel cell system 3 according to the amount of treading in of the accelerator of a car fluctuated according to transit of a car, the output of the fuel cell system 3 cuts with 3kW (A shows), 5kW (B shows), and 10kW (C shows), and replaces. If it processes as mentioned above, the fuel cell system 3 can be generated in an efficient part (30 - 33%), and a dc-battery 1 can be charged efficiently.

[0025] In addition, in processing of step 12 in drawing 3 to the step 17, since the processing which turns off a flag is not included, although the output of the fuel cell system 3 turns change on a high power side from 3kW to 5kW, and 5kW to 10kW, it does not change to a low-power output side. For example, although the 2nd flag will be turned on and the charge which is after it 5kW will be continued if a dc-battery charge becomes 70% or less (step 14;Y) when the output of the fuel cell system 3 is 5kW, the output of 5kW will be continued until a charging rate exceeds 90% (step 12; N), if it does not become 60% or less. Moreover, once an output is set to 10kW, the output of 10kW will be henceforth continued until a charging rate becomes 90%. For example, in drawing 4 (b), even if a charging rate increases from 60% or less of range E and it passes 60% or 70% of point P1, and P2, the output of the fuel cell system 3 is continued, without changing, as the output of 10kW shows by the arrow head C. Thus, changing the output of the fuel cell system 3 only to a high power side, and not making it change to a low-power output side is based on the following reason. That is, since it is necessary to prevent the fall of the battery life by exhaustion of the electrolytic solution when the charging rate of a dc-battery 1 falls, it is made to change to a high power side. In order to prevent these, even if a charging rate increases, he is trying not to make it change to a low-power output side, since a dc-battery will become easy to deteriorate by the repeat of charge and discharge while it will be necessary to change the output of the fuel cell system 3 frequently according to change of a dc-battery charging rate and the fuel cell itself becomes easy to deteriorate if it is made to change also to a low-power output side with the increment in a dc-battery charging rate on the other hand.

[0026] In addition, when attaching greater importance than to degradation of the fuel cell system 3 to the effectiveness of the fuel cell system 3, as shown in drawing 9 , it is [in / in connection with the increment in dc-battery remaining capacity / 60% and 70% of points P1 and P2] good [a charging rate] also as a configuration which changes the output of the fuel cell system 3 from 10kW of an arrow head C also to a low-power output

side like 5kW of an arrow head B, and 3kW of an arrow head A. However, in order to prevent the phenomenon in which an output changes frequently in this case bordering on 90%, 70%, and 60% of each charging rate, whenever fixed time amount passed, it may be made to perform activation of a dc-battery charge routine. Moreover, according to the increase and decrease of a condition of the charging rate of a dc-battery 1, fixed width of face may be given for 90%, 70%, and 60% of range. For example, when the dc-battery charging rate is falling, 89% is adopted, and when increasing, you may make it give **1% of width of face, respectively, and adopt 91%. In addition, in this case, in order to determine increase and decrease of a condition, it is necessary to leave the hysteresis of the charging rate of a dc-battery 1 within fixed time amount, and the field for it is secured to RAM which the electric vehicle control unit 7 does not illustrate.

[0027] (2) The 2nd actuation of the 2nd ****** of an example charges a dc-battery 1 according to the percent change of the charge remaining capacity of the dc-battery 1 computed with the electric vehicle control device 7, changing the output value of said fuel cell in the efficient range. In addition, since the main routine of whole actuation is the same as that of drawing 2 , explanation is omitted.

[0028] Drawing 5 expresses the processing actuation of a dc-battery charge routine based on the percent change by the 2nd actuation. As shown in this drawing 5 , from the operating electric energy of a dc-battery 1, and the charge from the fuel cell system 3, the dc-battery remaining capacity arithmetic unit 4 detects the charge (charging rate) of a dc-battery 1, and the electric vehicle control unit 7 is supplied (step 31). The electric vehicle control device 7 calculates the amount of increase and decrease of a dc-battery 1 from the need [of being supplied from motor control equipment 8] drive power signal Q2, and calculates the percent change of a dc-battery charge from these while it calculates the augend of the dc-battery 1 by the fuel cell system 3 from the output-value change signal Q5 currently supplied to the fuel cell control device 6 (step 32).

[0029] Subsequently, the electric vehicle control device 7 supplies the output-value change signal Q5 which sets up the output value of a fuel cell and corresponds from the calculated percent change and the charging rate of the dc-battery 1 supplied at step 31 to the fuel cell control device 6 (step 34). According to the contents (Q53, Q55, Q510) of this output-value change signal Q5, the fuel cell control unit 6 is outputting the output-value setting signal Q4 and the methanol input adjustment signal Q3, and the fuel cell system 3 charges a dc-battery 1 with the output based on the set point (step 35), and it carries out a return to a main routine.

[0030] Drawing 8 expresses the contents of the output change value signal Q5 supplied to the fuel cell control unit 6 according to the charging rate and percent change of a dc-battery 1. In this drawing 8 , (a) expresses the case where the dc-battery charge is decreasing, and (b) expresses the case where the dc-battery charge is increasing. The range of E shown in the lower berth of drawing 4 (b) when the dc-battery charge is increasing corresponds, and when decreasing, the range of D corresponds. The electric vehicle control unit 7 supplies the output change signal Q5 to the fuel cell control unit 6 according to each table shown in this drawing 8 . For example, if a charging rate is small and percentage reduction is high, when the charge of a dc-battery 1 is decreasing, in order to prevent overdischarge, Q510 is supplied to the fuel cell control unit 6 as an output change signal Q5. From the fuel cell system 3, a dc-battery 1 is charged with the output of 10kW by this. Thus, a dc-battery 1 is charged with such a big output, and a dc-battery 1 is charged with such a small output that the rate of increase is high when the charge is increasing conversely that percentage reduction is high when the charge is decreasing. In addition, although a charge considers as smallness inside in this example at 60% or less of case when [than 70%] more [at quantity and 90% or less / than 90% / and], it is possible to select other range freely. Moreover, it is possible into the quantity of a percent change to set it as arbitration also about smallness, and the contents of the processing change signal Q5 corresponding to the charge and percent change of a dc-battery 1 can still also be set up freely.

[0031] In addition, in this example, since the direct motor M is driven with the power of a dc-battery 1 corresponding to the motor rotation command of an accelerator, it can react with a sufficient response. Although 3kW, 5kW, or 10kW were chosen and it was outputted from the fuel cell system 3 in the example explained above according to the condition of a dc-battery 1 You may make it choose other values of 12kW or less by making 12kW into an upper limit as efficient range whose system overall efficiency is 30 - 40%, and four or more values may be set up as a selection branch of an output value. Moreover, although the output of the fuel cell system 3 was changed according to 90%, 70%, and 60% also about dc-battery charge remaining capacity, other values may be chosen as dc-battery charge remaining capacity, and four or more values may be set up as a selection branch of dc-battery charge remaining capacity.

[0032]
[Effect of the Invention] As explained above, the charge remaining capacity of a rechargeable battery is detected in this invention, and since the output value of the fuel cell which charges a rechargeable battery according to the remaining capacity is changed in the range for example, whose system overall efficiency is 30 - 40%, it can be used as an efficient hybrid power unit.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the system configuration Fig. of the electric vehicle with which the hybrid power unit in one example of this invention was applied.
[Drawing 2] It is the flow chart which shows processing actuation of the main routine of the same as the above and a hybrid power unit.
[Drawing 3] It is the flow chart which shows the 1st actuation of the dc-battery charge routine in the same as the above and a main routine.
[Drawing 4] It is drawing showing the data in the run state of the electric vehicle which applied the same as the above and a hybrid power unit, and drawing showing change of the vehicle speed [as opposed to time amount progress in (a)] and (b) are drawings showing the relation between the dc-battery remaining capacity to time amount progress, and a fuel cell output.
[Drawing 5] It is the flow chart which shows the 2nd actuation of the dc-battery charge routine in the same as the above and a main routine.
[Drawing 6] It is the block diagram showing an example of the conventional hybrid power unit.
[Drawing 7] It is drawing showing the output-effectiveness property in a fuel cell.
[Drawing 8] It is an explanatory view showing the contents of the output change value signal Q5 outputted from an electric vehicle control unit in the same as the above and the 2nd actuation.
[Drawing 9] It is drawing showing the data in the run state of the electric vehicle which applied the same as the above and a hybrid power unit, and is the explanatory view showing another example of drawing 4 (b) to drawing 4 (a).
[Description of Notations]
M Car motor
1 Dc-battery
2 Inverter
3 Fuel Cell System
4 Dc-battery Remaining Capacity Arithmetic Unit
5 Methanol Tank
6 Fuel Cell Control Unit
7 Electric Vehicle Control Unit
8 Motor Control Equipment

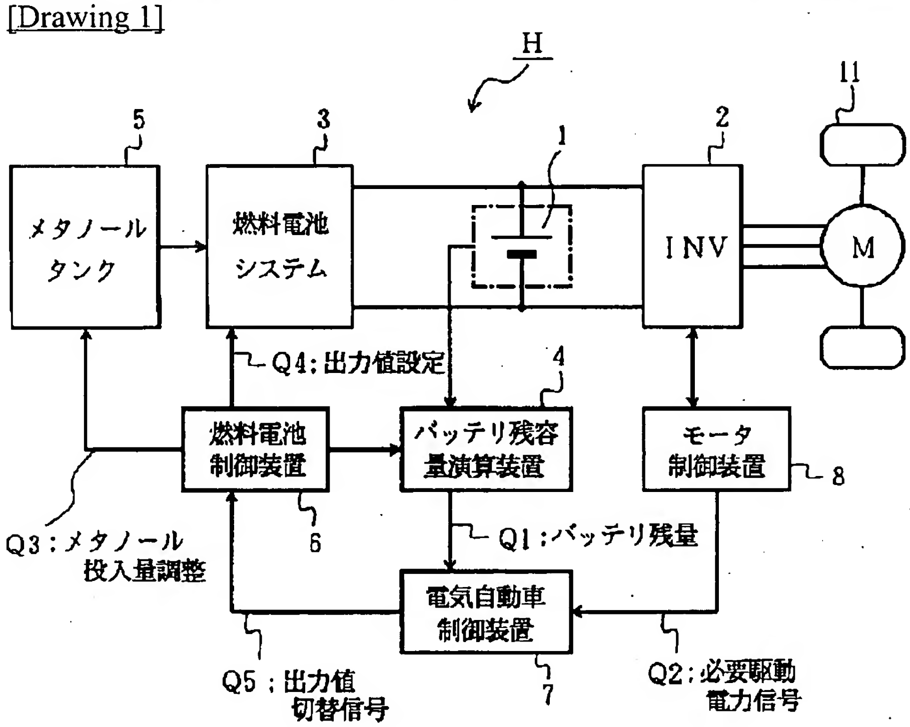
[Translation done.]

* NOTICES *

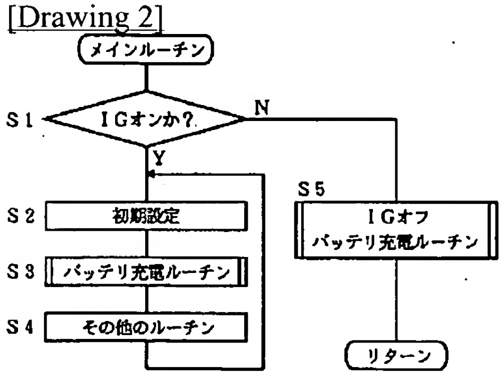
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

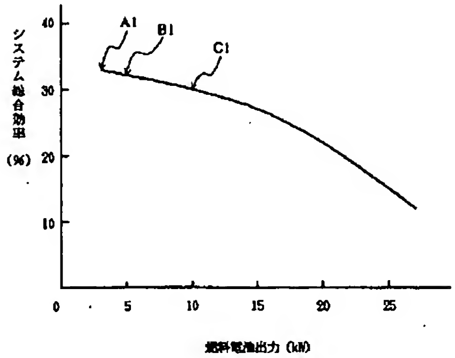
[Drawing 1]



[Drawing 2]



[Drawing 7]



[Drawing 8]

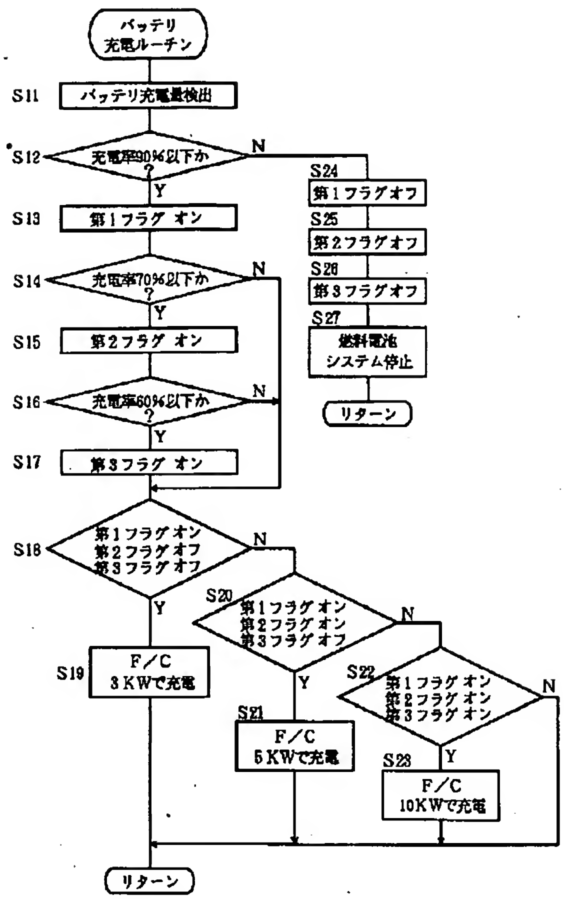
(a)

充電量＼減少率	高	中	小
高	Q55	Q53	Q53
中	Q55	Q55	Q53
小	Q510	Q510	Q55

(b)

充電量＼減少率	高	中	小
高	Q53	Q53	Q53
中	Q53	Q55	Q55
小	Q55	Q510	Q510

[Drawing 3]



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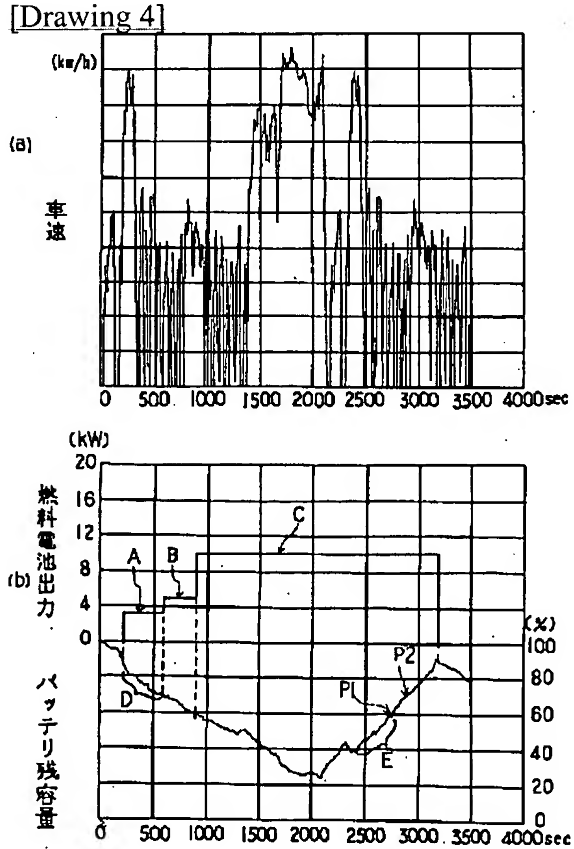
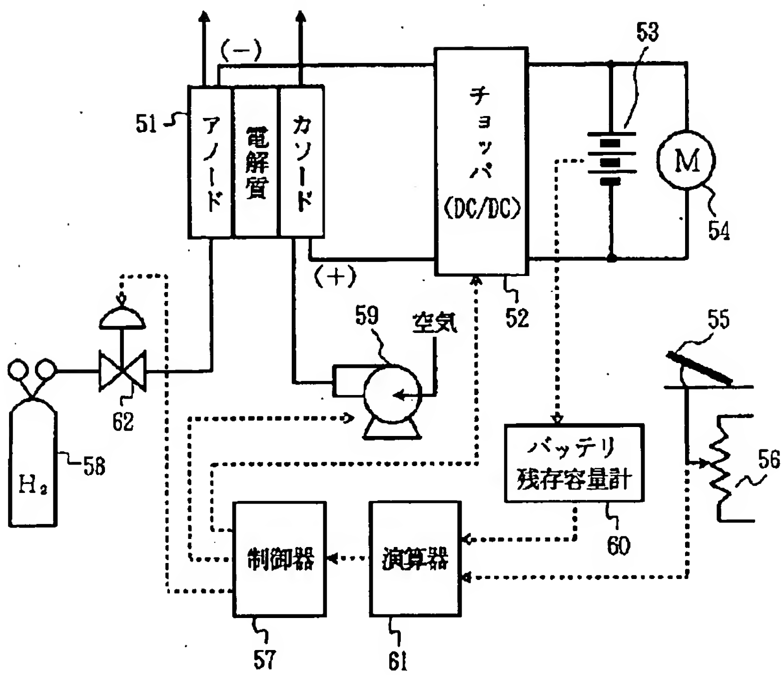
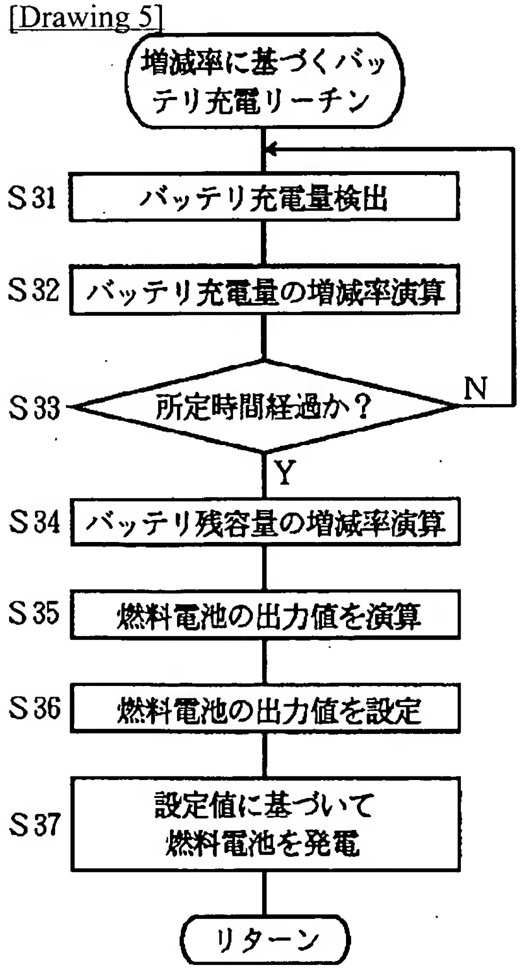


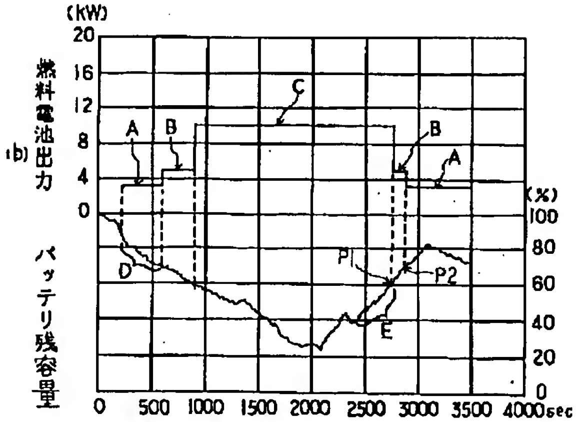
[Drawing 6]



[Drawing 5]



[Drawing 9]



[Translation done.]